**STANDARD 2-RIPARIAN/WETLAND HEALTH**

*Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel success and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.*

Riparian/wetland habitat makes up less than one percent of the Upper Colorado River Basin. Although this is a very small percentage of the basin, these areas are some of the most productive found on public lands. They are important for recreation, fish and wildlife habitat, water supply, cultural and historic values, as well as livestock production. The basin consists of a variety of riparian/wetland types ranging from perennial systems to intermittent in the higher country to ephemeral-dominated in the lower desert country.

**1) Characterization:**

The most common systems in the upper watershed are classified as riparian grassland and willow-waterbirch riparian shrublands. Less common systems include aspen and cottonwood riparian woodlands. Riparian grasslands are wetland, stream, or spring-associated grass and grass-like communities, which are maintained by water tables within root depth during most of the growing season (picture 34-1). These sites occur in lowland positions, generally at 5,850 to 8,400 ft. Dominant species include Nebraska and beaked sedges, Baltic rush, tufted hairgrass, basin wildrye, northern and canary reedgrass, Kentucky bluegrass, Nuttull's alkaligrass, and redtop. The shrub layer is sparse but willow and waterbirch may occur. Examples within the assessment area include: upper portions of Littlefield Creek, McKinney Creek and Little Savery Creek, and the headwaters of Deep Gulch, Wild Cow, and Cherokee Creeks.

The willow-waterbirch dominated riparian shrublands generally occur at 6,300 to 8,400 ft in locations which are too cool for cottonwood stands and too wet for aspen woodlands (34-2). The most common willow species in the watershed consist of Geyer, Booth, sandbar, and yellow willows. Additional shrubs are hawthorn, dogwood, currant, snowberry, rose, and individual quaking aspen. The herbaceous understory generally includes Nebraska sedge, beaked sedge, tufted hairgrass, Kentucky bluegrass and redtop. Several creeks support this type of community including; Littlefield Creek, Muddy Creek, Little Savery Creek, McCarty Creek, Bird Gulch, McKinney Creek, Dirtyman Creek, Morgan Creek, Truck Driver's Creek, and Savery Creek.

Aspen riparian woodlands have largely been eliminated in the watershed but consist of riparian areas dominated by quaking aspen. These sites occur on gentle "cool" (shaded or high elevation) slopes near springs or ponds, typically at 6,000 to 8,100 ft. Soils are poorly-drained and water tables are within root depth during most of the growing season. Overstory species are aspen, willow, and limber pine. The shrub layer is more open than either willow-waterbirch or cottonwood riparian sites and is dominated by common juniper and big sagebrush. Other species associated with this habitat type are shrubby cinquefoil, tufted hairgrass, letterman's needlegrass, wheatgrasses, bluegrasses, reedgrasses, sedges, and rushes in the herbaceous layer.

Cottonwood riparian woodlands are dominated by narrowleaf cottonwood, along with quaking aspen and box elder and are frequently intermingled with willow and riparian grasslands (picture 34-3). They occur on gentle, "warm" (sunny, lower elevation) slopes at 5,850 to 7,300 ft where water tables are within root depth during most of the growing season. The shrub understory is dominated by willows, currant, big sagebrush and rose; while the herbaceous cover is commonly basin wildrye, needle-and-thread grass, wheatgrasses, rushes, barley, and dock. Examples of this type of riparian community within the area include: Cottonwood Creek, Little Snake River, Loco Creek, Savery Creek, and Little Sandstone Creek.

Aquatic vegetation common in flowing systems in the watershed include brookgrass and eliocharis along the water's edge where areas are stabilizing (picture 34-4). These two species are colonizers and greatly accelerate stream channel narrowing and bank development. Pondweed and chara are the most common species found within the channels.

The remaining portion of the basin consists of ephemeral drainages, which flow only during spring runoff or in conjunction with intense thunderstorms. These areas do not meet the riparian standard in that they do not support wetland vegetation nor do they have hydric soils. Hydric soils are formed when there are long periods of water saturation, which produces anaerobic conditions within the soil (picture 35-1).

Wetland systems within the watershed include playa lakes, manmade reservoirs, seeps, springs, and wetlands, including the George Dew and Red Wash wetlands (pictures 35-2, 35-3). Large wetland systems support open aquatic-emergent wetland habitat (picture 35-4). They range from open expanses of deep water to shallow water bodies, that are choked with emergent vegetation. Dominant plants are Nebraska and beaked sedges, northern and canary reedgrasses, tufted hairgrass, cattail, rushes, Garrison foxtail, Baltic rush, bulrushes, potentilla, aster, mint and docks. In some cases there is a shrub layer dominated by inundated willow or waterbirch thickets.

Manmade reservoirs provide additional wetland habitat throughout the basin (picture 35-5). In the higher elevations, these systems are primarily herbaceous or willow riparian systems. In the lower elevations, wetland habitat along small reservoirs provide important habitat diversity in desert dominated upland vegetation communities. Reservoirs having more perennial water sources may support herbaceous riparian vegetation, while others may support woody species such as willows and even cottonwoods. Several of these reservoirs have been totally or partially fenced to protect their important habitat qualities. Those areas that have not yet been fenced in the lower elevations tend to have limited riparian vegetation due to yearlong wild horse and livestock use (pictures 35-6 thru 35-8). The majority of manmade reservoirs within the watershed tend to be ephemeral and do not support wetland qualities.

Seeps and springs are common throughout the area. These springs and seeps are discharged groundwater via fractures in underling rock or fault lines (Tiner et al., 2002). In the higher elevations, many of these springs provide the headwater sources and recharge perennial streams. In the lower elevations, many of these important water sources support a limited area and do not flow as a perennial lotic system. Many of these wet areas support or are capable of supporting riparian vegetation and wetland habitat of variable sizes.

The last type of wetland habitat found in this area are playa lake beds. During drier climatic cycles these depressional areas may lack hydrology and/or hydrophytic vegetation indicators that would identify them as wetlands. During wet years, they provide a productive and diverse composition, but during dry years the site may be dominated by upland species, particularly rhizomatous wheatgrass and annual forbs. Playas obtain water primarily from rainfall and local runoff and naturally go through several wet/dry periods over the years. However, given their capability and potential, most of these systems in the analysis area are in good health.

<u>Evaluation Method:</u>
The primary method used in evaluating this standard is through a qualitative assessment procedure called Proper Functioning Condition (PFC). This process evaluates physical functioning of riparian/wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. A properly functioning riparian /wetland area will provide the elements contained in the definition(need to add wetland indicators)

- Dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality
- Filter sediment, capture bedload and aid floodplain development
- Improve flood-water retention and ground water recharge
- Develop root masses that stabilize streambanks against cutting action (TR 1737-15 1998)

It is important to note that the PFC assessment provides information on whether an area is physically functioning in a manner that allows maintenance or recovery of desired values (e.g., fish habitat, neotropical birds, or forage) over time. PFC is not desired or future condition (TR 1737-15 1998). PFC assessments are used along with other existing information such as stream cross-sections, photopoints, and habitat assessments to evaluate this standard of rangeland health.

Within the watershed 63% were determined to be PFC, 36% were determined to be Functioning-At-Risk, and 1% were determined to be Non-functioning (see Map #6). In the upper watershed, several assessments of the same area have been completed, including a test case of the aerial photography method for assessing PFC, which was done by the National Science and Technology Center (NSTC). The findings of the NSTC group correlated with the ratings of the most recent PFC evaluations done on-site. Most of the area is either functioning properly or is functioning-at-risk with an upward trend, and therefore, moving towards the minimum standard. Specific areas that are not meeting this standard will be discussed individually.

**2) Issues and Key Questions:**

Livestock, wild horses, and wildlife grazing along riparian areas has been and continues to be an important factor relating to riparian health within the basin. Historic livestock grazing use that included trailing large numbers of livestock, much longer durations of use, herbicide spraying of riparian communities, trapping beaver out of the system, and the practice of using riparian zones as sacrifice areas contributed to the decline in riparian conditions. Current livestock and wildlife grazing use may be negatively impacting establishment and/or production of woody riparian plant species such as willows, dogwood, waterbirch or cottonwood in some portions of the watershed. In areas where wild horses are present, year round grazing use on riparian areas by horses and cumulatively by livestock and wildlife have negatively impacted riparian vegetation. The physical presence of grazing animals, whether domesticated or not, has a direct impact on riparian vegetation, and in some cases (depending on soil type) has resulted in hummocked riparian areas. If the area is hummocked, the riparian system may lose its ability to function and can essentially dewater a seep or spring. If livestock use has been addressed, how will damaged riparian areas be improved without exclusion of wild horses and/or wildlife?

Movement of animals through riparian areas can affect functionality by increasing bare ground, usually observed in the form of trails and crossings (pictures 36-1, 36-2). Higher numbers or an increased duration of use will create a greater impact and consequently more bare ground. Increased bare ground reduces the ability of the system to function properly in high flow events. In many cases, best management practices have been implemented which reduce the duration and/or change the season of grazing use for livestock. For example, reducing duration of use and developing upland water has resulted in trails re-vegetating. Continued refinement of these practices will address the current livestock grazing use aspect. Is trespass livestock use a part of the problem and if so, is it being addressed? What actions need to be taken to adequately address yearlong wild horse use and/or wildlife use of certain riparian areas?

There are certain areas within the assessment areas where hummock areas occur adjacent to riparian areas. Many of these are a factor of the soil involved and the historic long duration of livestock use that has occurred within the area. Will implementation of best management grazing practices address these areas at risk?

Reduced duration by livestock has greatly improved herbaceous vegetation vigor, composition, and density throughout the watershed. Many of these areas have responded favorably by producing a healthy herbaceous understory capable of maintaining riparian function. However, loss of woody vegetation due to past grazing practices, herbicide applications, lack of naturally occurring wildfire and wildlife use has greatly decreased woody plant communities. Aspen riparian communities are largely absent, and other woody dominated communities such as willow, alder, and water birch are greatly reduced in density and dominance. Unfortunately, in many of these systems, healthy riparian herbaceous vegetation may inhibit woody plant regeneration. Once these systems are dominated by a healthy herbaceous understory, woody plants don't have the microsites they require for reestablishment. Unless these areas are treated with high concentrations of livestock use to create bare soil or some other disturbance factor such as a high flow event, the woody species may not reclaim their original presence within the system. Disturbance is the natural way for this to occur, such as when beaver dams wash out and during high flow events and bare soil sites are created for seed-initiated species to start new plants and expand their populations. But with few beaver and 15 years since the last high flow event, these processes seldom occurred. Should short duration, concentrated livestock use be prescribed to cause disturbance on banks to create openings for these seed-borne species?

Plantings have been undertaken in the watershed; however, the scale of the area has hindered reestablishment efforts. For the most part, natural reseeding of rushes, sedges, and eleocharus has occurred. However, manual planting of other species has been the only successful way to increase other important species. Plugs of bulrushes and cattails are very successful, and cuttings of willow and other shrubs have varying levels of success. Will continued plantings and site-specific treatments result in desired future condition for many of these priority areas? In addition, will the herbaceous-dominated communities serve the same purpose for riparian objectives or will more intensive effort be needed?

Vertical instability is a problem throughout the watershed due to the fine sediments and, in some areas, naturally-erosive range sites. Several headcuts have been stabilized within the watershed; however, there are still areas that need to be addressed. Manmade structures such as reservoirs, created wetlands, and the extensive system of spreaderdikes northwest of Baggs also have instability problems due to naturally fine sediments. Cutting of the spillways on reservoirs or around or through dikes are ongoing problems affecting functionality. What is practical to address these instability issues?

Another factor affecting riparian health is roads and their associated impacts on these areas. Roads that are directly adjacent to riparian systems in many cases channel sediments directly into creeks and reservoirs. In addition, improperly-placed or improperly-sized culverts can increase erosion directly into riparian systems. If the amount of sediment is high enough, it can reduce vegetation, reduce functionality, decrease water quality, and change the channel dynamics. Roads can also interrupt surface and subsurface flow, which can effectively change the type of riparian system from one side to the other. Can road related concerns be addressed through culverts, rerouting, water bars, and roadside pits or are there additional solutions that can be implemented?

Given the potential for coalbed methane development in the area, will the groundwater that feeds the springs and seeps in the area be affected? While for the most part, water discharged from coalbed methane wells will be re-injected, drawdown and consequent reinjection could affect these important systems.

**3) Current Conditions**

PFC assessments have been conducted in the watershed since the mid 1990s, with the most recent assessments occurring in 2001. Several places in the upper watershed have been assessed more than once during that time. Extensive documentation of riparian condition including photopoints, greenlines, channel cross-sections, habitat quality assessments, and woody plant studies exist throughout the watershed.

**LOTIC SYSTEMS**:
Perennial streams in the upper elevations vary from the most common riparian area consisting of sedges and rushes stabilizing the stream channels, with or without a woody plants, to a few rock armored higher gradient channels (pictures 37-1, 37-2). The majority of these riparian areas are rated PFC. Healthy, vigorous sedge and rush communities stabilize the majority of these systems. Before management was implemented, many of these areas were dominated by upland grass species such as Kentucky bluegrass that is adapted to heavier grazing use. Upland forbs and other grass species resistant to grazing consequently increased along stream channels. These species may endure overgrazing but provide very little riparian stability. They have shallow roots that are not capable of stabilizing soils adjacent to riparian areas especially in high flows. With only upland species protecting the streambank, bank sloughing, bare ground, and vertical cutting were common. Platts et al. (1987) states that the highest rating for streambank alteration is when less than 25 percent of the streambank is false, broken down, or eroding. Where best management livestock grazing practices have been implemented, riparian herbaceous communities have responded quickly. As upland plants start moving out, early successional plants such as spike-sedge and creeping potentilla start coming in. Then sedges and rushes begin to dominate the riparian community. Along Little Muddy Creek, recent greenlines documented over 90% riparian vegetative cover, with Kentucky bluegrass largely absent within the wetter zones. Shortening duration of use, frequency of use, and timing of use has resulted in a vigorous, productive and, most importantly, stable forage base. Streambanks are lined with obligate and facultative riparian plants that are capable of holding together the riparian area even in high flows. These plants have deep and extensive root systems that stabilize the

channels and also play an important part in channel roughness during high flows and filtration of sediments. Little to no bare ground, channel sloughing, or instability in these systems is present today.

Although these herbaceous communities provide functionality, in many areas additional components are desired. Some of these systems have a woody component consisting of willow (Geyer, Bebb, Booth, sandbar), waterbirch, golden currant, dogwood, alder, or cottonwood. Current condition of many of these woody shrubs, especially willows, are primarily mature to decadent. Past livestock use has hedged many of the mature willow into mushroom shapes or eliminated them by heavy use or herbicide spraying (picture 38-1). Changes made in management has restored natural growth forms of these woody shrubs (picture 38-2). However, dominance of many of these riparian areas by herbaceous species such as Nebraska and beaked sedge and Baltic rush control the site so well that woody plant establishment has been minimal. Only in areas where there is bare soil has there been any woody regeneration. In this case, upstream implementation of a shorter duration of use and multiple years of rest have resulted in a very healthy Nebraska sedge-dominated riparian type. Downstream, implementation of a grazing system was slower, therefore livestock use and physical impacts were higher. This use resulted in more open areas allowing willow to establish throughout the pasture. It has been shown in the literature that for Bebb willow, high light intensities are necessary for seedling establishment, making dense sedge communities less conducive for willow establishment (Atchley and Marlow, 1989).

There are certain localized areas within the assessment area where wildlife use has also impacted the woody components of some riparian systems. High concentration areas of elk during transitions from summer to winter ranges has shown heavy browsing use on certain willow communities (picture 38-3). This use is increasing largely due to the increased numbers of wildlife, especially elk, over an ever-increasing area.

In most cases throughout the basin, livestock numbers have not been decreased to achieve riparian objectives. Depending on the specific situation, best management practices for livestock grazing have been implemented on a case-by-case basis in the majority of the watershed. In some cases, many practices and improvements needed to be implemented and in others, just a slight adjustment was needed.

In addition to adjusting duration and season of use by livestock in riparian areas, additional water sources have greatly improved riparian areas. Upland water developments such as spring developments, reservoirs, and pipelines reduce the dependence of livestock on riparian habitats and result in better distribution of the animals in a pasture. Specifically, spring developments protect the water source, improve water quality and flow, and provide greater flexibility in grazing rotations (picture 38-4). In some cases, pastures with riparian habitat are deferred to late summer or fall use. Pastures with primarily reservoirs and seeps are used first, saving the more reliable pastures with streams for late-season use. This has worked particularly well during drought.

Vegetation treatments, prescribed burning and herbicide applications, also improve distribution of both livestock and wildlife, while diversifying upland shrub communities and age classes. These treatments also increase water recharge into the overall riparian system resulting in higher and longer duration of flows. In some cases springs may start to flow that hadn't prior to treatment.

Fencing has been used to reduce duration of grazing on riparian habitats within most allotments. For the most part, there are few exclosures within the basin. Managing livestock use across the watershed by strategic placement of fences and other improvements has resulted in decreased grazing duration on riparian communities overall without the need for exclusion, complete rest, or decreasing AUMs.

Beaver are considered hydrologic modifiers in the PFC process (picture 38-5). This means they can directly affect stability of those systems that have a woody component. Beaver are present in the watershed, with more being present in the Savery Creek drainage than Muddy Creek due to habitat requirements (pictures 38-6, 38-7). Loss of willow over time has contributed to the reduction in beaver. Some experiments have tried to manipulate beaver into reclaiming stability and increasing woody species, with varying degrees of success. Large aspen were provided to the beaver, resulting in the stabilization of

one site along Littlefield Creek. In areas where there is limited woody plant density, beaver can dramatically reduce the woody component in a short period of time even when aspen is made available.

**Intermittent and Ephemeral drainages**
In the lower elevations of this watershed, riparian communities consist of mainly intermittent and ephemeral drainages, in addition to playa lake-beds (pictures 39-1, 39-2). These communities vary from riparian herbaceous-dominated to coyote willow- dominated to an absence of riparian vegetation of any kind. In many cases, these systems are higher in alkalinity, and plant communities must be adaptive to that condition). The systems having longer periods of water availability tend to have facultative wetland plants such as Nebraska sedge, bulrushes, and cattails. Most of these systems have historically downcut and are in a state of adjustment as described in the channel evolution discussion in Standard 1. The majority of the drainages in the south and western portion of this basin are ephemeral with little to no riparian vegetation. For instance, Sand Creek, which is classified as a braided channel, has no riparian vegetation for stabilization due to extreme fluctuations in water availability and channel variability.

***Lotic areas not meeting PFC that are livestock related:***

Cherokee allotment
The riparian areas within the Cherokee allotment are not meeting the minimum standard for riparian health due to season and duration of livestock use. The Cherokee allotment is an incommon use area with nine permittees who run both cattle and sheep. An allotment management plan (AMP) is currently being implemented to address these issues. Pasture development and numerous water developments along with adjustments of the livestock grazing operation will result in controlled season and duration of use and lead to improvements in riparian health. A good example of this can be seen from the bridge across Muddy Creek on the southwest border of the allotment. Muddy Creek in Cherokee allotment reflects season-long cattle use, while the picture looking downstream reflects the change after two years of controlled season and duration of use with both cattle and horses.

Sulphur Springs allotment
Portions of the riparian areas within the Sulphur Springs allotment are not meeting the minimum standard for riparian health due to season and duration of livestock use. This allotment is used by one permittee and is grazed by cattle, with the AMP recently revised to address riparian management concerns. Several range improvements have been developed within this allotment including fencing, water developments, instream structures, and plantings. Numerous photopoints have demonstrated improvements in riparian condition in many areas of the allotment (pictures 39-3, 39-4). However, some of the pasture boundaries within the allotment are topographic and are not effective at controlling livestock distribution and duration. Additional drift-fencing is planned to improve livestock management, in order for riparian systems to continue to heal and reach proper functioning condition.

Standard allotment
A small portion of Savery Creek within the Standard allotment is not meeting the minimum standard for riparian health due to duration and distribution of livestock use. The permittee is planning to construct a cross-fence on private land in order to rotate livestock use. Moving the allotment boundary so this small piece of Savery Creek is in an adjacent allotment, is a second possible option, that would greatly improve riparian condition by using it only for fall cattle use.

Rasmussen Subunit allotment
The lower portion of Bird Gulch was recently assessed and did not meet the minimum riparian standard. The remaining portion was found to be properly functioning. Historical use of the allotment included several permittees with season-long use, which caused the entire area of Bird Gulch to be in poor condition. Currently, there are only two permittees with a shorter season of use and light stocking rates. Most riparian areas have responded favorably to this improvement in management, however, the lower end still has some trespass and duration of use issues. In addition, cross-fencing and prescribed burning would also greatly improve riparian health.

Sage Creek allotment

Fish Creek was assessed in the mid 1990s, and portions were found to be Functioning-At-Risk either with a downward or static trend, and one portion was identified as non-functioning. Since that time, overall riparian condition has improved primarily due to variation in livestock use. Recently, Sage Creek allotment has come under new management, with a grazing plan and objectives, which should lead to more rapid improvement in condition. The majority of this allotment is in the Lower North Platte River watershed, therefore, it will not be assessed for S&Gs until 2004.

Pine Grove allotment
The majority of the riparian areas within the Muddy Creek portion of the allotment were found to be properly functioning. Since an intensive management plan was implemented on this allotment (over five years ago), riparian conditions have greatly improved. Upper McKinney Creek was once on the water impairment list for the state of Wyoming, but has since been delisted. The remaining riparian area that is not meeting the standard is lower McKinney Creek, which is being influenced by shale and heavy clay geologic units. Naturally erosive soils continue to influence the site potential of this particular riparian area. The majority of this allotment is in the Lower North Platte River watershed, therefore, it will not be assessed for S&Gs until 2004.

**LENTIC SYSTEMS**

George Dew Wetlands

The largest mosaic of wetland habitat within the watershed is the George Dew meadows. This area of Muddy Creek has been influenced by dikes, ditching, and irrigation for nearly 100 years. This floodplain is ½-¾ miles wide and was threatened by severe headcutting and spreader dike failure. These issues were addressed to ensure this habitat would be maintained. A cooperative effort between private landowners, BLM, NRCS, Little Snake River Conservation District (LSRCD), Ducks Unlimited, Snyder Oil, and many others made the improvement possible. The area has greatly expanded in size from 1000 acres to over 1500 acres. The riparian area is in PFC and provides open water and brood-rearing habitat for migrating waterfowl, nesting waterfowl, and other wildlife. This area is primarily a willow riparian habitat type merging into sagebrush/greasewood/grass on adjacent uplands. The drier fringes that flood infrequently are dominated by alkaligrass, meadow foxtail, rhizomatous wheatgrass, and some forbs. The area that is flooded in the spring has a high diversity of plants including: yellow and coyote willow, Nebraska, beaked, and wooly pod sedges, tufted hairgrass, American bulrush, reed canarygrass, Garrison creeping foxtail, Baltic rush, spikesedge, mint, cinquefoil, plantain, arrowgrass, aster, and milkwort. Production varies from one ton per acre in the drier areas, two to four tons per acre in sedge-dominated areas, and six to eight tons per acre in reed canary grass areas. Livestock grazing of the George Dew is carefully balanced to maintain healthy willow communities for beaver and mule deer habitat while closely grazing some grassy areas for spring waterfowl use.

Red Wash Wetlands

This is a relatively new wetland formed by spreader dikes constructed adjacent to Muddy Creek with water controlled through an irrigation ditch. When this project is completed there will be an additional 210-220 wetland acres. Common species found in this riparian wetland habitat include: alkaligrass, tufted hairgrass, sloughgrass, northern reedgrass, wheatgrass, coyote willow, cattail, and various sedges, rushes, bulrushes, and forbs.

Manmade reservoirs/Seeps/Springs

Several manmade reservoirs, both large and small exist throughout the area. Several were built in the 1960s, and many of these support riparian and wetland habitat. Larger reservoirs have been built recently by the LSRCD to fulfill several purposes, including livestock and wildlife water, wetland and riparian habitat, and fishery values. A very large reservoir on Savery Creek is being constructed in the upper watershed that will have multiple values including irrigation water, recreation, and additional Colorado River cutthroat trout habitat.

***Lentic areas not meeting PFC that are livestock related:***

The following allotments are located west of Hwy 789 and were evaluated in the first two years of the standards and guidelines process. They tend to have very limited riparian vegetation, usually in small areas around springs, seeps, and reservoirs.

In the Powder Mountain allotment, the 1998 S&G evaluation rated Upper Powder Springs as Functional At Risk with an upward trend. Factors identified that were affecting this riparian area were both livestock and wild horse use. In 1999, a spring was developed and fenced.

The Powder Rim allotment was also evaluated in 1998, and two springs (Chimney and Rotten) were determined to be non-functional due to livestock grazing. In addition, Lower Soap Holes was found to be Functioning-At-Risk with a downward trend due to livestock grazing. Since that time, both the Chimney and Rotten Springs have been repaired. Lower Soap Holes is scheduled in the Range Improvement work plan for 2002.

Both the Cow Creek and Espitalier allotments were evaluated for S&Gs in 1999, and the team found that the Kinney Rim Seep Complex was Functioning-At-Risk with a downward trend due to livestock and wild horse use. This seep complex is scheduled for initial development in 2002.

In the Adobe Town allotment, the S&G evaluation found that Carson Spring Reservoir was Functioning-At-Risk with a static trend, and Moonshine Springs was rated non-functioning due to livestock and wild horse use (picture 41-1). The reservoir has already been cleaned and no additional work has been identified for Carson Spring. Moonshine Springs is currently being repaired.

The 1999 S&G evaluation in the Grindstone Springs allotment found that Grindstone Spring itself was Functioning-At-Risk with a downward trend due to wild horse use (picture 41-2). This spring is also currently being repaired.

The Sand Creek allotment was also evaluated in 1999 for S&Gs, and the Hartt Cabin artesian well and a seep were found to be Functioning-At-Risk with a downward trend, also due to wild horses. Both of these sensitive riparian areas will be excluded from livestock and wild horse use in the fall of 2002.

Lastly, Red Creek allotment was found to have a seep Functioning-At-Risk during the 1999 S&G evaluation. This riparian area will be developed and fenced to exclude use during 2003.

The above allotments have all been addressed regarding livestock grazing since their initial assessments. However, wild horse impacts continue throughout the area. A gather has been is scheduled for the last two years, but until the numbers of horses are at AML, their impacts continue throughout the area. Even when the numbers reach AML, the impacts of yearlong grazing in sensitive areas will continue to occur.

**4) Reference Conditions:**

As stated in Standard 1, the Stansbury expedition noted small willows and currant bushes and farther upstream there were many more willows, currant-bushes, and birch, and several beaver dams. Loss of this important woody component is an identified concern within the basin. There are only a few areas that may hint at the relic conditions. Littlefield Canyon shows a marked difference in species composition from an allotment that was heavily utilized by livestock and an allotment that has been historically lightly-used. Only willow remains where there was historical heavy use, but below the fence a much more diverse community consisting of dogwood, golden currant, water birch, and alders is prevalent. Many of these species tend to be selected for by grazing animals and also tend to be unarmored. Those species that are more resistant to grazing, less desirable, or armored by thorns or stickers tend to remain. On a widespread basis, perhaps much of the upper watershed provided a more diverse shrub community than is currently present.

Savery Creek was wooded with willow thickets according to Fremont. In this same watershed, McCarty Creek is very similar to the way Savery Creek was described. This creek was primarily used by sheep and tended to be used in a way by livestock that maintained the healthy willow community ("thicket") that was noted as prevalent in the area. The creek is lined with willows and has numerous beaver dams throughout. In lower gradient areas, huge expanses of beaver ponds are common.

The Little Snake River was classified as a considerable stream wooded with cottonwood and thickets of willow and buffaloberry. The valley remains this way today. Miles of cottonwood galleries are common along the main channel and in the lower drainages flowing into the Little Snake River.

Barrel Springs was referred to as "abrupt gullies and ravines, formed by the wash from the hills, and in many places the ground is covered by a crust of impure soda to the depth of half an inch. The little stream whose valley we had followed to the Gate, pursued a wandering course to the south-east through the prairie, its existence marked only by an occasional clump of willows." This is very similar to the way this area looks today. Springs and seeps in the area tend to support a riparian grassland that is saline-influenced and usually intermingled with greasewood-dominated saline lowland. Herbaceous species are varied and include alkali sacaton, inland saltgrass, basin wildrye, spike sedge, Baltic rush, Nebraska sedge, alkali bluegrass, wheatgrasses, arrowweed, sea milkwort, cinquefoil, and other forbs. Light stocking rates, dormant season of use by cattle, and minimal use by sheep has maintained this area. Within its capability and potential, this area demonstrates healthy riparian production and water availability.
Riparian areas (and uplands for that matter) throughout the area evolved over millions of years as a natural grazing ecosystem. The fossil record in the Intermountain West indicates herbivory in the past was comparable to the Serengeti in diversity (Burkhardt, 1996). Burkhardt also summarized other studies of the presence of large herds of bison and their existence in this region until the early 1800s. Large herds of bison grazed this entire assessment area; a bison skull was found buried in Littlefield Creek Canyon in the upper watershed, and many others have been found west of Highway 789.

**5) Synthesis and Interpretation:**

Muddy Creek has always been a high priority for the Rawlins Field Office and has had additional attention and several studies by the University of Wyoming in the 1980s. Information gained from these studies include bank sealing by clay particles, requiring overbank flows to provide moisture to sustain bank vegetation, otherwise coyote willow and other riparian species die back due to lack of water even though there is water in the stream channel. Root growth studies of willow stem plantings showed that bank stability can be enhanced with willow plantings (picture 42-1). Using this knowledge, over ten miles of stream channel have been planted with willows to speed up restoration of riparian habitat (picture 42-2). This research and use of portions of the Muddy Creek watershed as a demonstration area has resulted in very positive improvement throughout the assessment area. Projects including reservoirs, stream structures, and the extensive system of spreader dikes clearly demonstrate the commitment to improve this area over the years. In the early 1990s the LSRCD formed a Coordinated Resource Management (CRM) Group for the upper Muddy Creek watershed. This area included the area south of I-80, west of Hwy 71, and east of Hwy 789 to the Savery Creek watershed. The original goals of the group included:

1. Increase cooperation, coordination, and trust among landowners, permittees, agencies and interest groups.
2. Improve critical ranges for antelope, elk, and deer in the area.
3. Demonstrate that properly managed livestock grazing can be compatible with consumptive and non-consumptive use of the area
4. Improve water quality and reduce erosion and sedimentation. Restore the riparian habitats to their desired future condition. This will consist of visible changes in the plant community, stream channels, and hydrologic regimes. It includes improvement of existing woody plant communities and their restoration to previously occupied sites.
5. Reestablish Colorado River cutthroat trout to headwater streams.
6. Manage upland habitats to improve their biodiversity and productivity for selected wildlife species and domestic livestock.

This CRM effort has received national attention and funding through organizations such as the National Fish and Wildlife Foundation, EPA 319, CUP, and was an original Seeking Common Ground award recipient. Demonstrating significant riparian improvement has led to the production of videos to spread this cooperative effort in rangeland health improvement on a larger scale. Since the time of the original CRM formation, efforts and involvements have reached past these boundaries and are prevalent throughout the assessment area. As stated earlier, much of the area has already greatly improved due to implementation of best management practices, a few examples of which follow.

Historic heavy livestock use by sheep and cattle in numbers and chemical treatment of willow communities greatly degraded the riparian systems in the Grizzly allotment. This allotment is in the upper Muddy Creek watershed and provides the headwaters of Muddy Creek, Little Muddy Creek, and Littlefield Creek. Willows were mushroom shaped (if they were present), Kentucky bluegrass and dandelion dominated the riparian community, and bank erosion was widespread. The allotment was finally addressed and received two years rest, and then a new allotment management plan (AMP) was implemented. The allotment had an old AMP; however, it was not followed and needed modification to adequately address riparian concerns. The Wyoming Game and Fish Department attained the base property in the early 1990s and leased the grazing to Desert Cattle Company. Numerous improvements have been implemented since that time, many of which were paid for by LSRCD through the EPA 319 funding, BLM, and WGFD. These include: three cross-fences, several spring developments and reservoirs, five vegetation treatments, stream structures, and plantings. These improvements have resulted in shorter grazing duration, better livestock distribution and quicker restoration of the riparian systems (pictures 43-1, 43-2). In addition, one of the original goals of the Muddy Creek CRM was to reestablish Colorado River cutthroat trout; that was achieved in the fall of 2001in Littlefield Creek. As part of that reintroduction effort, the main stem of Muddy Creek and East Muddy are the next location for the trout.

In 1991, the WGFD established Habitat Quality Index (HQI) sites to monitor fishery habitat in the trout reintroduction area. HQI is a tool that can be used to assess fluvial trout habitat. Most of these sites have shown improvement since they were put in. A representative site of this monitoring along lower Littlefield Creek is depicted in Table #3 below:

TABLE #3 - STREAM HABITAT COMPONENTS

| Components | 1991 | 1993 | 1995 | 1997 | 1999 | 2001 |
|---|---|---|---|---|---|---|
| Average stream width (ft) | 5.9 | 5.0 | 4.8 | 5.2 | 5.1 | 4.3 |
| Average stream depth (ft) | 0.4 | 0.7 | 0.7 | 0.4 | 0.6 | 0.6 |
| Stream Flow (CFS) | 0.9 | 1.4 | 1.4 | 1.4 | 2.2 | 1.6 |
| Cover (%) | 13 | 15 | 15 | 11 | 11 | 33 |
| Eroded banks (%) | 10 | 20 | 38 | 5 | 3 | 11 |
| HQI Score | 2.9 | | | 5.7 | 4.2 | 6.1 |
| Habitat Unit | 8.5 | | | 11 | 9.7 | 11.5 |

There are some variations upward and downward over the years, due to specific grazing management during that year and seasonal differences between years. However, the entire upper watershed has responded overall and continues to improve.

The Morgan Boyer allotment in the southern portion of the watershed has one of the highest stocking rates within the field office and has five permittees. By implementing management tools such as drift fencing, upland water development, prescribed burning, vegetative plantings, and instream structures, the riparian area was greatly improved and the stocking rate was maintained. In this case, riparian willow greatly benefited from the improvement in management. Grazing use along the creek kept the young regeneration of whiplash, Geyer, and Coyote willows at less than six inches tall. Since the improvements were implemented in 1992, willows and cottonwoods are already 6-12 feet tall (pictures 43-3, 43-4). This stream system and others throughout the region are often dominated by sedges, with Nebraska sedge the most common species (picture 43-5). It is a deep-rooted, rhizomatous species that helps to stabilize banks, is

productive, and very nutritious. Another species of interest is American mannagrass (picture 44-1). Severely reduced by season-long cattle use, this plant species is observed along most streams where rotation and deferred rotation grazing systems have been implemented. It is similar to Nebraska sedge in terms of helping stabilize banks, being nutritious, and is easily observed with its big flowering head waving three to four feet in the air along creeks.

The Doty Mountain allotment is grazed by one permittee, Weber Ranch, and is located on the middle portions of Muddy Creek. Range improvements including pasture fencing, stream structures, vegetation treatments, and water developments have resulted in enhanced riparian function. Although Muddy Creek in this area was historically downcut and in some cases has 10-15 ft sidewalls, within that new floodplain a healthy riparian area has been established. Given the potential of this riparian area, substantial improvement has been documented over the past years. Vegetation has changed greatly within the riparian zone. Species shifted from annuals and early successional species to more long-lived riparian species. In several cases, willow, sedge, and rush species, which are important for bank stabilization, were found in 1997, where none existed in 1989. In three different cross-section locations, the riparian area was dominated by bare ground and early successional plants. Within eight years, the dominant plants were perennial riparian species, including several grasses, wild licorice, bulrushes, and coyote willow.

In the Savery Creek drainage, the Savery Creek allotment supports riparian areas that are rated as properly functioning. The permittee, Tall Grass LLC, constructed crossfences and spring developments and has a longterm vegetation treatment schedule planned to continue improvement; unfortunately, historic photos are not available. Tall Grass LLC has also acquired a new allotment to the north (Morgan Creek allotment) in which it has constructed a crossfence and developed springs in the one year it has managed the allotment. Riparian conditions have greatly improved due to more intensive management and consequently shorter duration of use. This improvement has been achieved through efforts and investment of the permittee, with some assistance from NRCS and BLM.

One of the most important benefits of improved riparian health in this area is the support and cooperation of all those involved. A commitment by all parties in the area has resulted in substantial improvements in riparian health, and even more importantly, a dedication to continue these successes and promote riparian health outside the area. Cooperation by permittees, federal and local government, conservation groups, and many other entities have made this improvement possible. A list of all cooperative entities in this ever-expanding project is part of the CRM literature.

Another positive outcome of this cooperative effort is the support of the groups involved. Any proposal to try a new method or solution is supported in order to see if it is successful. Several of these experiments have resulted in riparian improvement. Limiting road width, construction of waterbars and digging roadside pits to catch sediment have resulted in riparian improvement. In many cases, the upper Muddy Creek watershed was viewed as an experimental area. If projects worked they were implemented elsewhere. Even if a experiment is not successful, the group is still supportive and willing to continue to try innovative solutions. Currently, McCarty Creek has some severe erosional problems due primarily to the county road location. Cooperative efforts between the BLM and the Carbon County Road and Bridge Department will address these problems in an effort to reverse the riparian degradation.

Although many of the riparian areas have been addressed, some still need attention. Rasmussen subunit allotment historically had several permittees, and Bird Gulch was identified as one of the worst riparian areas within the assessment area. By constructing division fences and creating separate allotments, riparian condition has improved for the most part. A chronic trespass problem on the lower end and more degraded condition continues to be a problem. A crossfence has been proposed, and upland vegetation treatments, as well as a more substantial enforcement of livestock supervision, are necessary.

In the wild horse herd areas, the issues are much more problematic. Increased horse numbers and no control of their use results in the degradation of important riparian areas. Livestock use is being addressed; however, until wild horse numbers are reduced and a more efficient management regimen of these animals is implemented, conditions will continue to suffer. The reduction of wild horse numbers is a vitally important step.

**6) Recommendations:**

There has been a tremendous improvement in riparian/wetland condition within the assessment area over the last 15 to 20 years. However, there are still areas that need attention. Allotments containing riparian/wetland habitat that do not meeting this standard have been described previously and include: Cherokee, Sulphur Springs, Standard, Rasmussen, Sage Creek, Pine Grove, Powder Mountain, Powder Rim, Cow Creek, Espitalier, Adobe Town, Grindstone Springs, Sand Creek, and Red Creek allotments. For lotic systems that are not meeting the minimum standard, there are 119 miles out of a total 319 miles. In lentic sites, there are 5 acres of a total 17 acres, that do not meet the minimum standard.

Most of the lentic and lotic sites not meeting the standard have been, or are in the process of being addressed in management plans or as range improvement projects. Continued progress in grazing management of livestock and wild horses(where they are present) will ensure further improvement of all riparian areas within this area. Although there are areas where desired future condition is yet to be reached in woody species dominance and composition in the upper watersheds, these areas still meet the minimum standard of rangeland health. Other than the specific allotments listed previously, the remainder of the allotments within this assessment area are meeting Standard #2 – Riparian/Wetland Health.

Continue to implement or manage using best management practices (BMPs) for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for riparian habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, additional fencing, water developments, and vegetation treatments. Address trespass livestock problems, particularly where it is not the livestock operator permitted within an allotment.

Identify and correct impacts from improved roads, including water flows and erosion into riparian systems. Two-tracks that are negatively impacting riparian areas should be identified and addressed.

Continue plantings within the watershed. Hundreds of woody shrubs have been planted throughout the watershed with varying degrees of success. The LSRCD, in conjunction with the NRCS, has also developed some planting trials in the upper watershed to compare different species' establishment success. In addition, in lentic areas both woody and herbaceous species have been planted with high levels of success. In many cases, these manmade wetlands don't have the desired natural diversity of wetland plants. When just a few individuals are planted, they establish exceedingly well.

It is critically important that the numbers of wild horses in the assessment area are reduced to AML as soon as possible. Impacts to riparian resources in these areas will continue as long as wild horses are present in the area. However, this degradation will be greatly reduced when horse numbers are reduced and subsequently maintained at that level.

Continue existing projects to protect riparian habitat and provide off-site water for wild horses and livestock.

Continue to expand the beneficial practices that improve riparian health and maximize public involvement and education regarding resource issues.